

**CLAIMS:**

1. A process for synthesising hydrocarbons, which process includes  
feeding a gaseous feedstock comprising hydrogen, carbon monoxide and carbon  
5 dioxide, into a dimethyl ether (DME) synthesis stage;  
in the DME synthesis stage, converting a portion of the gaseous feedstock into a  
DME product and gaseous products;  
separating the DME product from unreacted gaseous reactants and the gaseous  
products to obtain a tail gas comprising hydrogen and carbon monoxide;  
10 feeding the tail gas into a Fischer-Tropsch hydrocarbon synthesis stage; and  
allowing the hydrogen, carbon monoxide and carbon dioxide at least partially to  
react catalytically in the Fischer-Tropsch hydrocarbon synthesis stage to form  
hydrocarbons.

15 2. The process as claimed in claim 1, in which the Fischer-Tropsch hydrocarbon  
synthesis stage is a two-phase high temperature catalytic Fischer-Tropsch hydrocarbon  
synthesis stage, the hydrocarbons formed in the Fischer-Tropsch hydrocarbon  
synthesis stage thus being gaseous hydrocarbons at the operating pressure and  
temperature of the Fischer-Tropsch hydrocarbon synthesis stage.

20 3. The process as claimed in claim 1 or claim 2, which includes adjusting the  
composition of the gaseous feedstock so that the gaseous feedstock has a syngas  
number (SN) between 1.8 and 2.2, where

25 
$$SN = \frac{[H_2] - [CO_2]}{[CO] + [CO_2]}$$

30 and where  $[H_2]$ ,  $[CO]$  and  $[CO_2]$  respectively are the molar proportions of  
hydrogen, carbon monoxide and carbon dioxide in the gaseous feedstock.

4. The process as claimed in any one of the preceding claims, in which  
converting a portion of the gaseous feedstock into a DME product and gaseous

products includes contacting the gaseous feedstock with a catalyst or catalysts that enhance methanol synthesis and methanol dehydration reactions.

5. The process as claimed in any one of the preceding claims, in which the DME product includes a mixture of DME and methanol and which includes converting the DME product into light olefins in a light olefins production stage without increasing the DME concentration in the DME product.
6. The process as claimed in any one of the preceding claims, which includes recycling a portion of the tail gas from the DME synthesis stage to the DME synthesis stage, a ratio of tail gas recycle to gaseous feedstock being between about 0 : 1 and about 2 : 1.
7. The process as claimed in any one of the preceding claims, in which the DME synthesis stage is operated at conditions suitable to ensure that overall CO + CO<sub>2</sub> conversion in the DME synthesis stage is between about 20 % and about 80 %.
8. The process as claimed in any one of the preceding claims, which includes recycling some of the Fischer-Tropsch hydrocarbon synthesis stage tail gas to the Fischer-Tropsch hydrocarbon synthesis stage, to obtain high overall CO + CO<sub>2</sub> conversions in the Fischer-Tropsch hydrocarbon synthesis stage of at least 80 %.
9. The process as claimed in any one of the preceding claims, which includes recycling some of the Fischer-Tropsch hydrocarbon synthesis stage tail gas to the Fischer-Tropsch hydrocarbon synthesis stage, a ratio of Fischer-Tropsch tail gas recycle to the tail gas from the DME synthesis stage fed to the Fischer-Tropsch hydrocarbon synthesis stage being between 2.5 : 1 and 1 : 1.5.
10. The process as claimed in claim 5, which includes, in a separation stage, separating light hydrocarbons from the Fischer-Tropsch hydrocarbon synthesis stage tail gas and converting these light hydrocarbons, together with the DME product, into light olefins with a carbon number from 2 to 4 in the light olefins production stage.

11. The process as claimed in claim 5 or claim 10, in which gaseous hydrocarbons and any unreacted hydrogen, unreacted carbon monoxide, and CO<sub>2</sub> are withdrawn from the Fischer-Tropsch hydrocarbon synthesis stage, and separated into one or more condensed liquid hydrocarbon streams, a reaction water stream and a Fischer-Tropsch hydrocarbon synthesis stage tail gas, the process further including treating the condensed liquid hydrocarbons from the Fischer-Tropsch hydrocarbon synthesis stage, to provide a light hydrocarbon fraction, including naphtha, which is converted, together with the DME product, in the light olefin production stage to light olefins, and to provide a diesel fraction.

12. A process as claimed in claim 5 or claim 10 or claim 11, which includes using separation equipment to recover C<sub>2</sub>-C<sub>4</sub> light olefins from the Fischer-Tropsch hydrocarbon synthesis stage and in which C<sub>2</sub>-C<sub>4</sub> light olefins from the light olefins production stage are recovered using the same separation equipment that is used to recover the C<sub>2</sub>-C<sub>4</sub> light olefins produced by Fischer-Tropsch synthesis.